

Sept. 17, 1968

B. VAN DER WERFF

3,401,661

HOPPER BARGE

Filed Oct. 10, 1966

6 Sheets-Sheet 1

FIG. 1

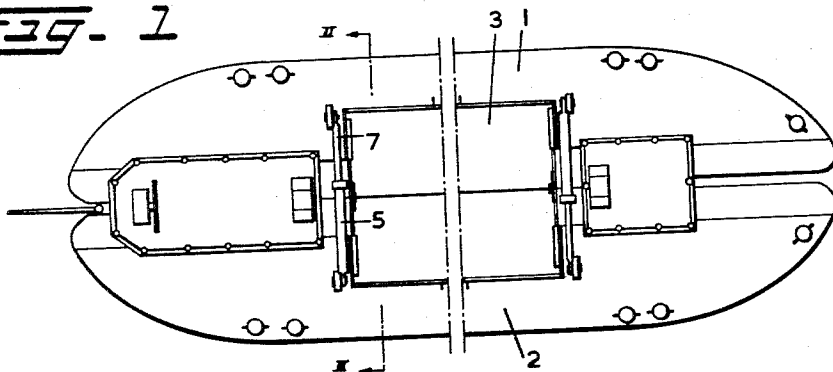
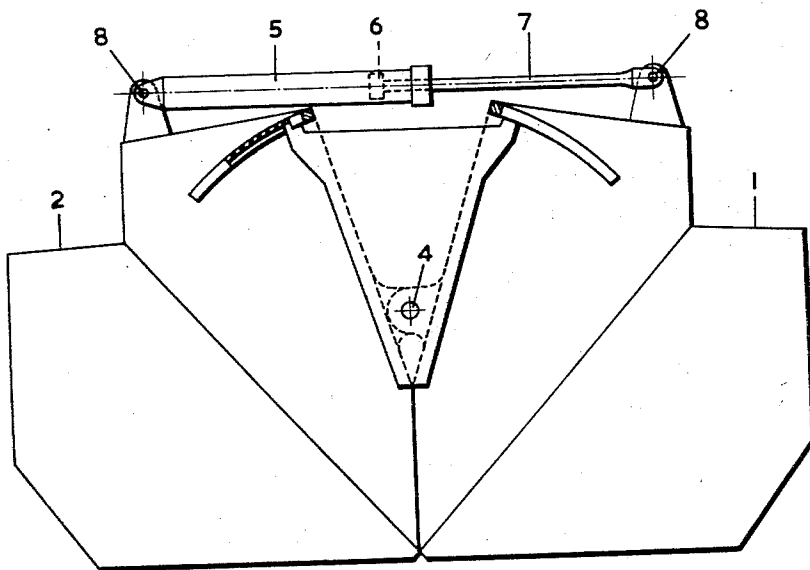


FIG. 2



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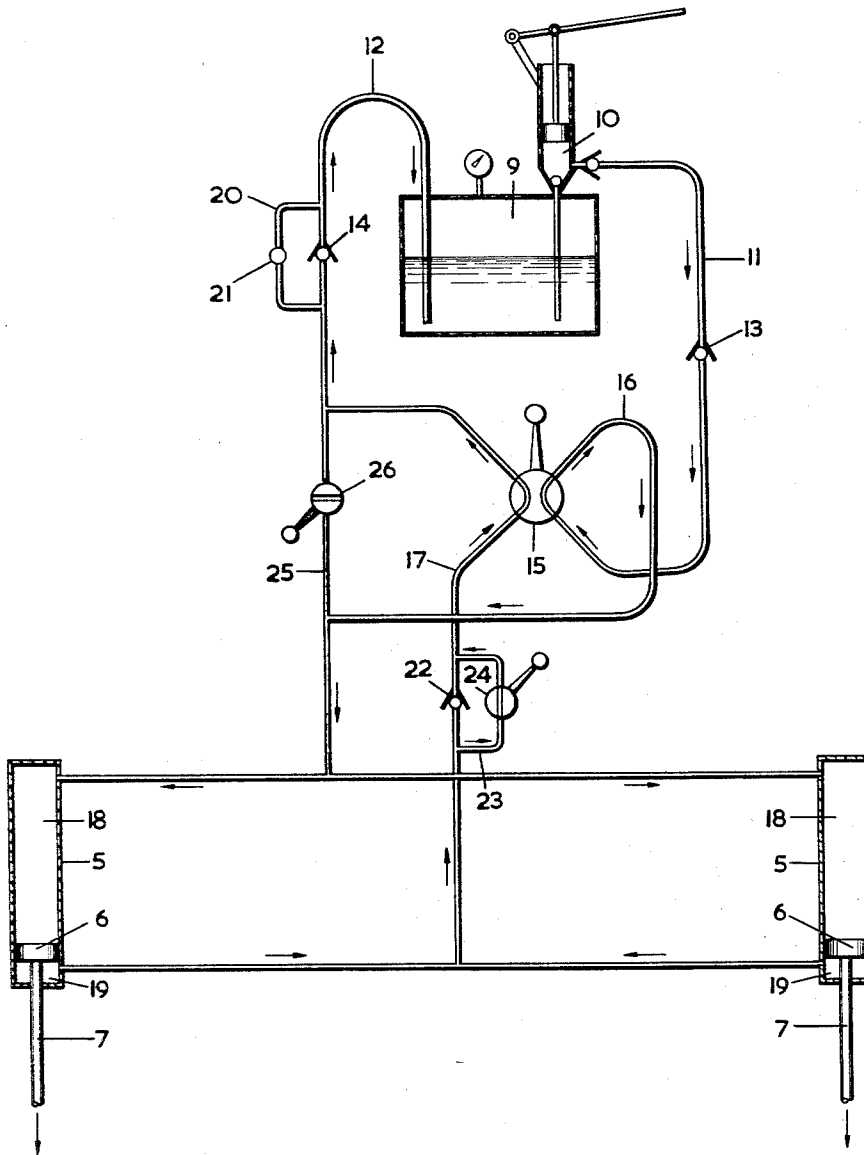
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**FIG. 2**



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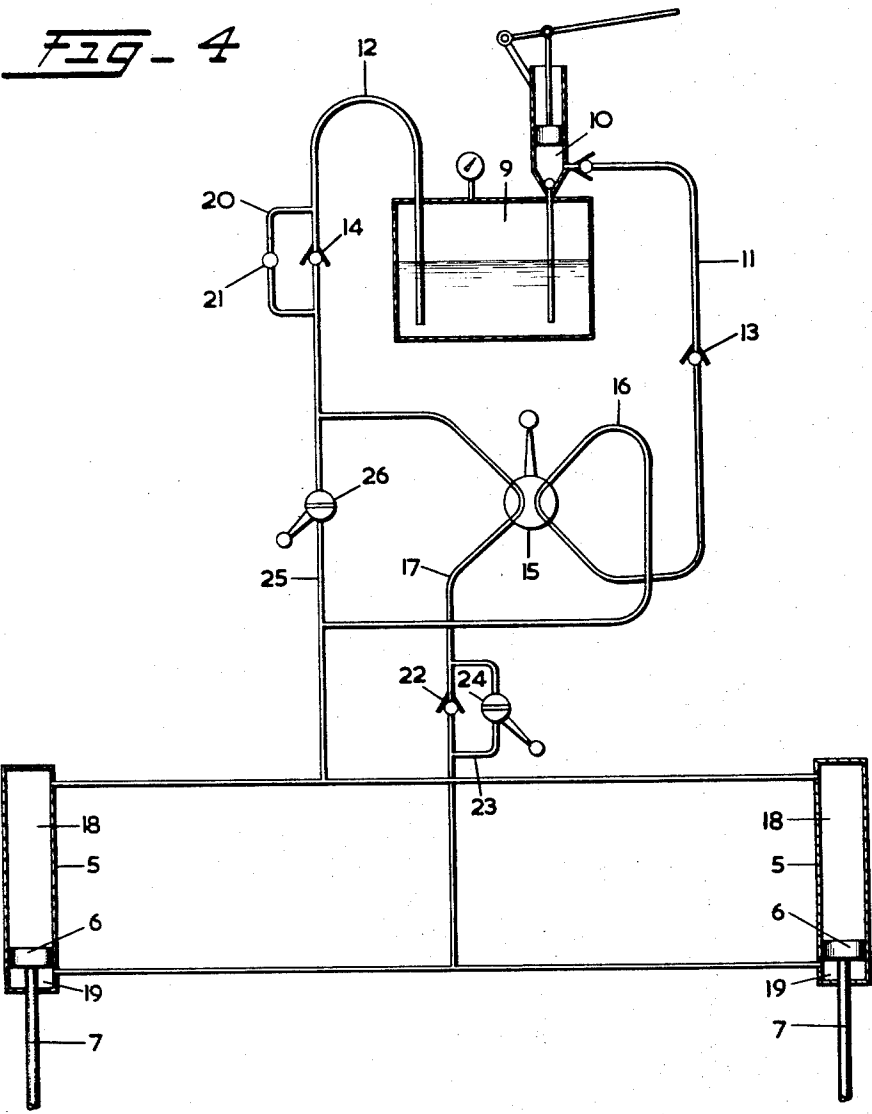
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Fig. 4



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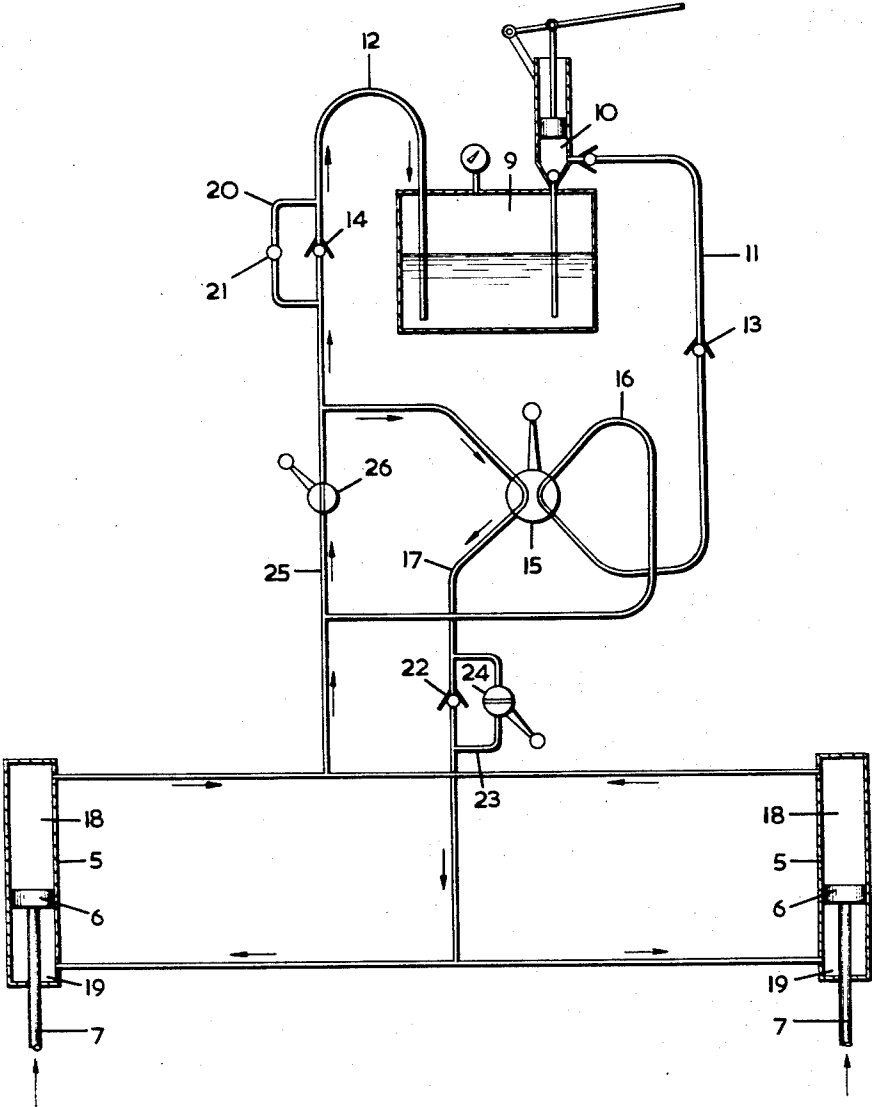
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*FIG. 5*



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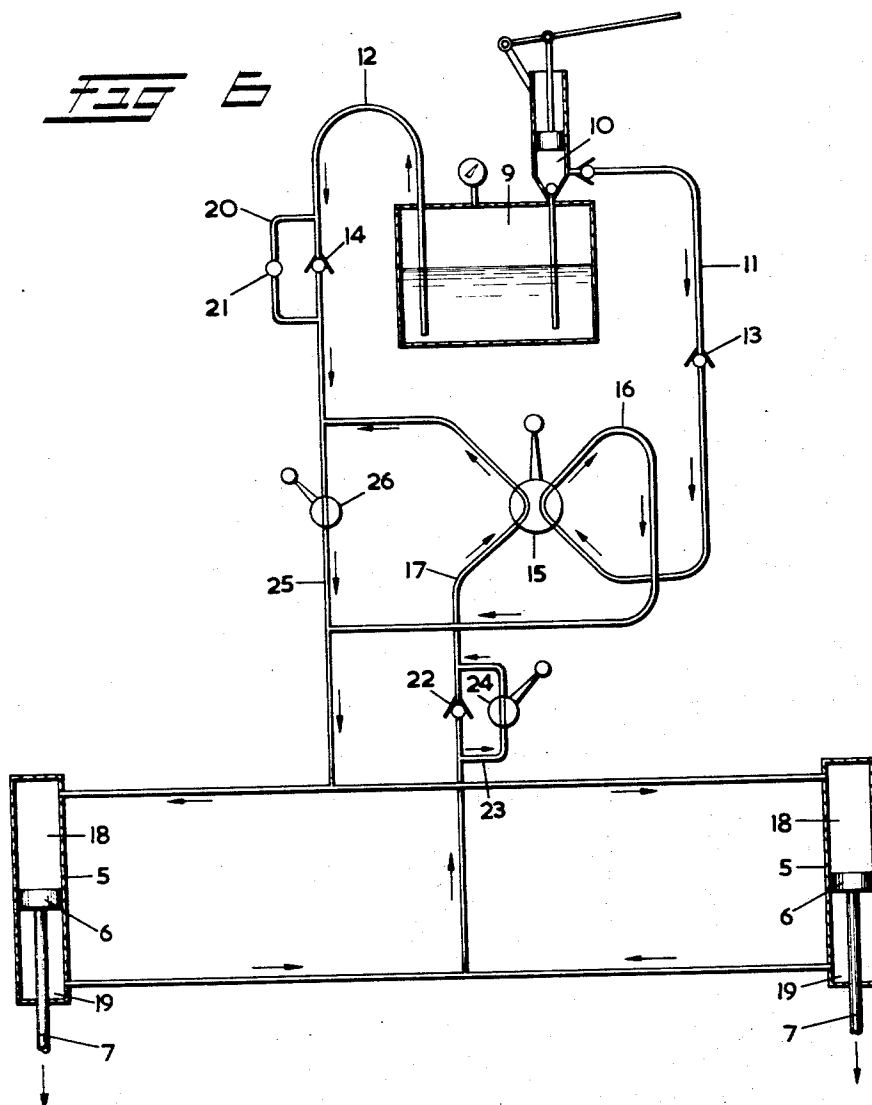
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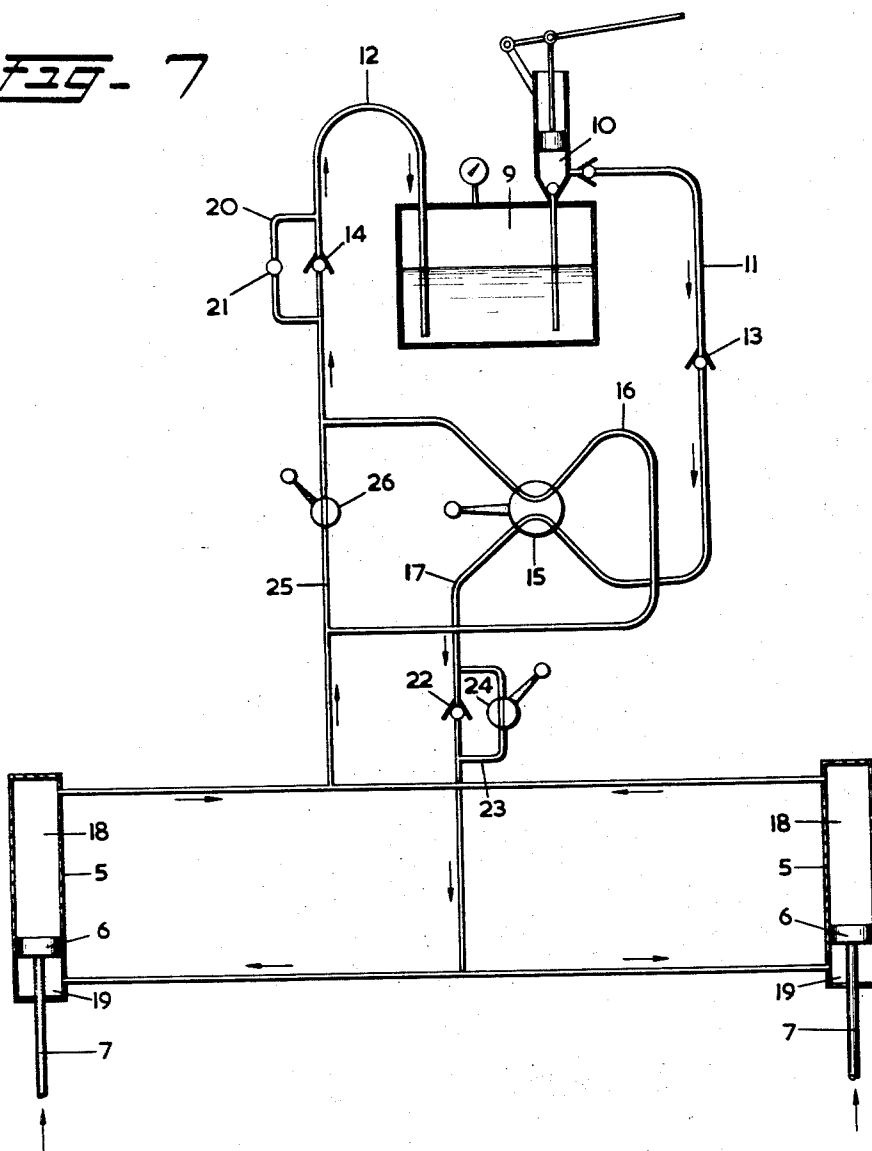
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Fig. 7



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## HOPPER BARGE

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Claims priority, application Netherlands, Oct. 22, 1965, 6513713

2 Claims. (Cl. 114—29)

### ABSTRACT OF THE DISCLOSURE

A hopper barge comprising two pivotably connected floating body elements and a valved hydraulic circuit to control closing and opening of the cargo space defined between the floating body elements by hydraulic pump pressure, the power of a load in said cargo space, and the floating power of said body elements respectively.

The present invention relates to a hopper barge consisting of two longitudinal air chambers which are hinged together by a shaft positioned approximately midway between the deck and the bottom of the barge, and which enclose a cargo space disposed between said chambers, there being provided above the deck of the barge one or more doubleacting hydraulic cylinders with opposite ends each in engagement with a different ship's half.

A hopper barge of this type is disclosed in Dutch Patent 106,086, in which the ship's halves, in the unloaded condition of the vessel, tend to assume the closing position owing to the floating ability of the air chambers, which closing position, however, in the loaded condition of the vessel, is maintained by the action of the hydraulic cylinders. However, the automatic adjustment of the ship's halves to the unloading position must not be hampered by the hydraulic cylinders, and the untimely return of the ship's halves to the closing position is to be prevented. It must also be possible for the ship's halves to move simply some distance in the direction of the unloading position to enable an obstacle which has become jammed between the ship's halves, to be removed, in order to permit the halves to return to their closing position.

These requirements impose special conditions on the hydraulic operating mechanism of the ship's halves, and are even more complicated due to the practical demand that this mechanism should be operable in a simple manner and preferably by remote control.

The present invention offers an efficient solution to the problems resulting from the foregoing.

To that effect the operating mechanism for each hydraulic cylinder in the hopper barge according to the invention comprises a pressure reservoir with discharge pump, a pipe connected to said pressure reservoir and another connected to said discharge pump, which pipes are both provided with a non-return valve and are connected to a four-way valve, the other branches of which are connected by a pipe respectively to one working space and to the other working space of each hydraulic cylinder, there being provided a by-pass with throttle valve for the non-return valve connected in the pipe between the pressure reservoir and the four-way valve, and a non-return valve with a by-pass having a two-way valve in the pipe between the four-way valve and said one working space of each hydraulic cylinder, the pipe between the pressure reservoir and the four-way valve and the pipe between the four-way valve and the other working space of each hydraulic cylinder being interconnected by a pipe having a two-way valve.

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In illustration of this invention one embodiment will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of the hopper barge;

FIG. 2 is a section taken along the line II—II in FIG. 1; and

FIGS. 3—7 show schematically different positions of the operating mechanism for the hydraulic cylinders.

Referring to FIGS. 1 and 2, the hopper barge consists of two air chambers 1 and 2 which define a hold or cargo space 3 therebetween and are hinged together by coaxial shafts 4 approximately midway between the deck and the bottom of the barge.

The relative positions of the air chambers 1 and 2 are controlled by two hydraulic cylinders 5 each with a piston 6 and a piston rod 7. The opposite ends of each cylinder and rod are secured to the deck of the adjacent air chamber by hinges 8.

The mechanism for operating the hydraulic cylinders is schematically shown in FIGS. 3—7. This mechanism is provided with a pressure reservoir 9 for a pressure medium, to which reservoir is connected a discharge pump 10 with a pressure pipe 11 and a pipe 12. Each one of these pipes 11 and 12 has a non-return valve 13 and 14, respectively, and they are connected to a four-way valve 15. The two other branches of the four-way valve 15 are connected to a pipe 16 and a pipe 17, respectively, the pipe 16 leading to the working space 18 and the pipe 17 to the working space 19 of the hydraulic cylinders 5. Added to the non-return valve 14 is a bypass 20 with throttle valve 21, while the pipe 17 has a non-return valve 22 with by-pass 23 and a two-way valve 24 connected therein. Furthermore, pipes 12 and 16 are interconnected by a pipe 25 and a two-way valve 26 connected therein.

When the hopper barge is being loaded, the air chambers 1 and 2, which have been brought to the closing position as a result of their floating capacity, are to be held in that position by means of the hydraulic cylinders 5. To achieve this, the medium in the working space 18 of the cylinders 5 is pressurized by means of the discharge pump 10 with the valves 15, 24, and 26 in the positions shown in FIG. 3, and subsequently that medium is held under pressure by the check valve 13. In the position of the valves 15, 24 and 26 shown in FIG. 4 the pistons 6 are blocked against movement in any direction and so the unloaded or loaded hopper barge can be sailed away without any risk of relative movement of the halves 1 and 2 with respect to each other.

After arrival at the destination, the valve 26 is switched to the position shown in FIG. 5. This enables the pressure medium to escape from the working space 18 of the cylinders 5, and to flow partly by way of the pipe 12 and the throttle valve 21 to the pressure reservoir 9 and for the rest by way of the pipe 17 and the non-return valve 22 to the working space 19 of the cylinders 5, whereby the ship's halves 1 and 2 move to the unloading position by virtue of the weight of the load. The risk that the ship's halves return to their closing position due to their rising force before the hopper barge has been completely unloaded is avoided thereby because the medium fed into the working space 19 of the cylinders 5 is unable to flow back into the pipe 17 as a result of the action of the non-return valve 22, whereby the unloading position of the ship's halves 1 and 2 remains locked.

To enable the ship's halves 1 and 2 to return to the closing position owing to their rising force, the valve 24 is moved to the position shown in FIG. 6, so that, when the ship's halves are returning to the closing position, the pressures in the working spaces 18 and 19 of the cylinders 5 can be equalized by way of pipes 17, 23, 12, 25, and the valves 24, 15, and 26.

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If, during the return movement of the ship's halves 1 and 2 to the closing position, an obstacle should become jammed between said halves as to prevent complete closure thereof, the valve 15 is adjusted to the position shown in FIG. 7 and the discharge pump 10 is operated to allow pressure medium to be fed into the working space 19 of the cylinders 5 in quantity sufficient to move the ship's halves apart from each other over a distance necessary to release the obstacle. Afterwards, the ship's halves 1 and 2 can return to the completely closed position when the valve 15 has been readjusted to the position shown in FIG. 6.

By maintaining pressure in the reservoir 9 it is assured that the working spaces 18 and 19 are always kept filled up with medium independently of any movement of the pistons 6 and notwithstanding the resistance in the pipe lines against the flowing of the medium.

Not only has the invention resulted in a very simple structure of the mechanism for hydraulically controlling the movements of the ship's halves of a hopper barge of the subject type, but also in the possibility of operating that mechanism by remote control, for example, from a tug.

I claim:

1. A hopper barge comprising first and second floating body elements defining a cargo space, pivot means connecting said elements together, at least one hydraulic double-acting cylinder and piston assembly, said piston including a piston rod and said cylinder having a first working space at the side of said piston remote from said piston rod and a second working space at the side of said piston facing said piston rod, said cylinder and said piston rod extending transversely of said pivot means and each being pivotably connected with a respective floating body element, hydraulic actuating means to operate said cylinder and piston assembly for pivotal movement of said floating body elements relative to each other to open and close said cargo space, said hydraulic actuating means comprising a tank, a pressure pump having an intake side connected to said tank, a four-way valve, a pressure pipe line connecting the pressure side of said

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pump to said four-way valve, a check valve in said pressure pipe line between said pump and said four-way valve, a return pipe line connected with and between said four-way valve and said tank, a combined check and throttle valve in said return pipe line between said four-way valve and said tank, a first connecting pipe line between and connected with said four-way valve and said first working space and a second connecting pipe line between and connected with said four-way valve and said second working space, said four-way valve being movable between two positions to connect in one of said positions said pressure pipe line with said first connecting pipe line and said return pipe line with said second connecting pipe line and to alternately connect in the other one of said two positions said pressure pipe line with said second connecting pipe line and said return pipe line with said first connecting pipe line, a check valve with a by-pass pipe line including a two-way control valve in said second connecting pipe line, and an inter-connecting pipe line with a two-way control valve arranged between and connected with said first connecting pipe line and said return pipe line at a location therein intermediate of its combined check and throttle valve and said four-way valve.

2. A bottom dump barge according to claim 1, in which said tank is a pressure tank.

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